

IMPROVING THE TEACHING OF PROGRAMMING COURSES IN TERTIARY INSTITUTIONS USING INFORMATION AND COMMUNICATION TECHNOLOGY TOOLS

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Abstract

The integration of Information and Communication Technology (ICT) tools into the school system has influenced the way teachers work, learn, teach and carry out research in recent time. Computer programming courses are taught to computer science students at the Colleges of Education, Polytechnics and Universities in the department of Computer science. The paper reviews the potentials of ICT tools as used by teachers to support the teaching of computer programming courses and effective delivery of instructions to students at tertiary institutions. Despite the enormous potentials of ICT tools to support teaching, several factors have been found to hinder its effective usage at tertiary institutions which include inadequate ICT facilities in tertiary institutions, lack of basic technology skills by lecturers in the tertiary institutions to implement the teaching of computer programming curriculum in an interesting manner. The need for government to provide personal computers, laptops and smart boards to tertiary institutions as well as the need for management of tertiary institutions to provide capacity building workshops for lecturers are part of the recommendations of this paper.

Keywords: Information and Communication Technology, Programming, Smartboard, Multimedia and Tertiary Institutions.

Introduction

Information and Communication Technology (ICT) has turn out to be the driving force for effective and efficient operations of every profession, including Education, commerce, government, medicine, human resources development, national security and other areas of human endeavour. In the field of education, ICT has changed the way both lecturers and students engaged in research, teaching and learning activities. Bottino (2003) asserted that ICT tools can influence and transform learning by changing the way in which content can be taught and learnt. Studies revealed that ICT has been used over the years to support and complement the teaching and delivery of instructional objectives at all levels of education in an effective manner (Albert and Mercedes, 2010). In tertiary institutions, ICT tools have been deployed in the classroom to assist lecturers to deliver learning instructions to their students and this has helped to change the pedagogical approach from teachers' centred to students' centred approach.

Computer programming courses form vital courses taught to students in the department of Computer Science in Colleges of Education, Polytechnics and Universities. Programming is the process of writing instructions to tell a computer what to do and how to do it. Every task achieved by any computing device is program driven and there are several programming languages that can be used to develop programs and applications. Examples include: Visual Basic, JavaScript, C or C++, C# and Python, each with their own specific set of rules, but also following many universal programming principles. Programming the computing device helps to automate, collect, manage, analyse data and information correctly. Most Computer Science students find it difficult to design and write programming codes to create applications either as a result of poor programming background on their part or poor teaching method used by their lecturers in teaching programming courses (Mohorovicic and Strcic, n.d.; cited by (Sarpong, Arthur, and Amoako, 2013). They noted that computer programming is among the most challenging subjects in computer science curriculum, and the one that many students find difficult to grasp, hence it is very important to select an appropriate pedagogical approach that will provide students with the most efficient learning environment. This paper is therefore focused on the review of how ICT tools can be used to support and improve the teaching of computer programming courses to students in an interesting and effective manner and suggest improvements for its effectiveness.

ICT tools required in Programming Class

Information and Communication Technologies are important tools that have been found to be very useful in the classroom environment as they have the ability to engage students to learn and work either independently or collaboratively. Yusuf (2005) opined that ICT help relate school experiences to work practices, create economic viability for tomorrow's workers, as well as strengthening teaching and helping schools change. He also noted that the field of education has been affected by ICTs, which have undoubtedly affected teaching, learning and conducting research. In recent times, teachers have been using ICT facilities to support lessons and instructional delivery in the classroom system. These tools when effectively used, can enhance students' academic performance as each student is able to work and develop at his or her own pace, thus making the learning process more flexible and directed.

The popular method used for teaching programming courses at tertiary institutions such as Colleges of Education, Polytechnics and Universities is the lecture method which involves the use of chalk and talk. Programming courses consist of theoretical concepts, algorithms and coding which can best be explained and demonstrated practically through practical session, simulation and multimedia approach. Albert and Mercedes (2010) noted that while the teacher talks and acts, pupils/students listen, watch and write. They argued that such type of education using the conventional approach did not change so much and remained teacher centred. With the emergence of new technological devices for handling text, picture and sound, new possibilities for knowledge transmission emerged.

Programming courses require the student to have basic knowledge of data input and output, data structure, data manipulation, syntax of the computer language etc. Over the years, such programming concepts are usually taught to students using the lecture approach with little or no emphasis on practical aspect of the course thereby leaving the students in confusion.

In order to cause change in the teaching of programming courses in the tertiary institutions, it will require the integration of relevant ICT tools into the classroom system. ICT hardware devices such as computers, mobile or smart phones, public address system, digital camera, projectors, interactive whiteboard, etc. combined with appropriate software can aid teaching and learning of programming courses in an effective manner. Interactive whiteboard (also called Smartboard) is a large, touch-sensitive panel that connects to a digital projector and a computer, displaying the information on the computer screen. It resembles a traditional whiteboard and is used in a similar fashion. The computer connected to the interactive whiteboard can be controlled by touching the board directly or by using a special pen on the board. Actions such as input are transmitted to the computer instead of using a mouse or

keyboard. Alternatively the user or teacher can as well control teaching activities by using the popular input device such as mouse or keyboard. Interactive whiteboards present educational resources in a highly interactive way and are suitable for whole class and small group settings. A well prepared programming course organized in PowerPoint presentation can be delivered to a large class of 100 students and above, with the aid of a whiteboard without stress. This will allow students to engage and interact with the technology to become active participants in learning. Similarly, students with special needs can particularly benefit from the presentation of multimedia content on a large screen as it can aid in both information processing and retention.

Technology Approach in Teaching Programming Courses

Finger and Trinidad (2002) emphasized that technology-based teaching and learning offer various interesting ways which include educational videos, simulation, and storage of data, the usage of databases, mind-mapping, guided discovery, sound and world wide web (www) that will make the learning process more fulfilling and meaningful. Many studies have shown that there is a positive effect associated with technology aided instruction and teaching (Burnett, 1994; Fitzgerald and Warner, 1996; cited by Emmanuel and Barau, 2013). Teaching programming course requires the ability to think and develop algorithm needed to solve computing based problems. In a situation where the instructor or lecturer does not understand both theoretical programming concepts properly and the algorithms approach taken to develop programs, it becomes very difficult for the learners to comprehend the lesson. Hence, most students of computer science and Information Technology departments find it difficult to create, design and implement programs.

ICT tools can be used by lecturers at tertiary institutions for lesson preparation and instructions delivery of programming courses in the following ways:

Use of mobile device accessories: Accessories available in mobile devices such as camera can be used to snap pictures and record video clips; voice recorder can be used to capture voice information during programming practical class which can be played back at future date.

Use of web browsers and search engines: Web browsers and search engines can connect teachers or lecturers into internet environment and download relevant information to create lecture notes for students. The search engine can be used to search both text and images which may serve as teaching aids in a given lesson. Word-processors can be used to create and edit

programming tutorial which can be converted into PDF assessable by several hardware platforms.

Use of You-tube and customized videos: Video is one of the most exciting multimedia element used to teach programming concepts and practical illustrations to students. They are available on the You-tube platform for all learners. The lecturer can use such videos to prepare himself adequately and also refer the video link or its URL to the students. Haddad and Haddad (2005) opined that multimedia motivate and engage the students in the learning process, foster inquiry and exploration, and provide access to worldwide information resources, among others.

Use of Learning Management System (LMS): Learning Management System is a software system that provides a virtual learning environment for a lecturer to create, distribute, and manage the delivery of educational content to students. Lecturers can utilize one of the open source LMS platforms such as Moodle or Google Classroom to manage and distribute programming course content to students.

Use of Flipped Classroom model: The flipped classroom model can be used to engage and enhance the teaching of programming course to students. Barseghian (2011) described flipped classroom model as a form of blended learning in which the students learn new content online by watching video lectures, usually at home, and what used to be homework (assigned problems) is now done in class with teacher offering more personalized guidance and interaction with students. ICT tools assure high quality of students' learning outcomes through wide access to learning content via the web and other electronic learning platform.

Challenges associated with ICT usage in Teaching Programming Courses

1. *Unavailability of appropriate ICT tools needed to support the teaching and learning process.* ICT facilities such as PCs, Projectors, Public Address System and Interactive Whiteboard which usually make the teaching of programming courses interesting and interactive are not available for lecturers to use. Evoh (2007) noted that despite the recognized role of ICTs in improving education, ICTs remain a low financial priority in most educational systems in Africa. He stated that most countries in the region lack resources for a sustainable integration of ICTs in education, and that African countries face numerous competing development priorities.
2. *Teacher's inability to make use of the ICT technology which can also be traced to lack of skills and proper knowledge of ICT usage.* Some lecturers do not have the required skills to operate an interactive board or create lesson in digital format using slides presentation

via laptop and projector. Tapan (2009) observed that teachers' lack of knowledge and skills is one of the main hindrances to the use of technology in education both for the developed and underdeveloped countries.

3. *Lack of technology skills through capacity building on regular basis for lecturers to update their knowledge.* Using technology to improve the teaching of programming courses requires that the lecturer needs to acquire the relevant skill as well as the ability to integrate it into the teaching environment. Emmanuel and Barau (2013) asserted that several factors posed as challenges for ICT integration and usage in the school system. These include limited or poor information and communication technology infrastructure, Lack of/inadequate ICT facilities in schools, frequent electricity interruption, non-integration into the school curriculum, poor ICT policy/project implementation strategy, inadequate professional manpower in the schools, and poor management on the parts of school administrators and government and lack of limited ICT skills among teachers.
4. *Cost of internet connectivity.* For example, in Nigeria, it is still very expensive to access a broadband network suitable for browsing and engaging in self-development from the YouTube environment. Again, some environments lack reliable network penetration and sometime the internet network fluctuates at certain time of the day. Brakel and Chiseuga (2003) stated that cost of internet connectivity are equally very high and exorbitant where they are available in urban areas and the charges for satellite television are unaffordable for most people in Africa.
5. Lack of commitment on the part of the lecturers as result of poor remuneration and lack of motivational incentives (such as leave bonus, excess work allowance), capacity building on ICT usage from the government.

Conclusion

Programming courses are a core component of computer science curriculum and they are major requirement for graduating students in computing discipline at the tertiary institutions. Computer science graduates are therefore supposed to be well equipped with programming skills during their period of education at the tertiary institutions. It is imperative that management of tertiary institutions in synergy with other stakeholders in computing departments should be able to select appropriate teaching strategy that will provide students with the most efficient learning environment equipped with modern ICT facilities to guarantee efficient computer science education. Information and Communication Technology (ICT) tools are very useful for teaching and learning programming courses at the tertiary institutions. It

also helps teachers to design their lesson plans in an effective, creative and interesting approach that would result in students' active learning (Ghavifekr and Rosdy, 2015).

Recommendations:

The following recommendations are hereby made for the improvement of teaching and learning of programming courses in tertiary institutions:

- i. Corporate organizations and the government should provide modern ICT facilities such as personal computers, public address systems, projectors and smart boards as well as relevant programming software needed for practical classes in computing department.
- ii. The Government through the Ministry of Education should provide Internet facilities as well as provision of constant maintenance of the facilities for all tertiary institutions.
- iii. Computer science lecturers, especially those that teach programming courses should be properly trained and be re-trained from time to time on new ICT skills and technology usage.
- iv. The telecom industry and the various Internet Service Providers (ISPs) should reduce the cost of internet connectivity to enable lecturers in tertiary institutions access the internet easily and without much cost.
- v. The management of tertiary institutions should organize capacity building workshops for lecturers on regular basis to acquire new skills and best approaches to deploy ICTs into the classroom system.

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